INTERNATIONAL SOLDIER SYSTEMS CONFERENCE AND EXHIBITION 2004

Future Force Warrior (FFW)

System of Systems Architecture, Integration & Interoperability

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The Science Behind the Warrior: Yesterday, Today and

FFW System of Systems Objective

- **Provide Ground Soldier & Small Combat Unit (SCU)**
  - Dominant Knowledge & Understanding
  - Dominant Lethality
  - Dominant Maneuver
  - Dominant Survivability & Endurance

Fundamental Enablers		
Disruptive Technology	***Soldier Centric Integration***	***Revolutionary Tactics, Techniques & Procedures (TTPs)***

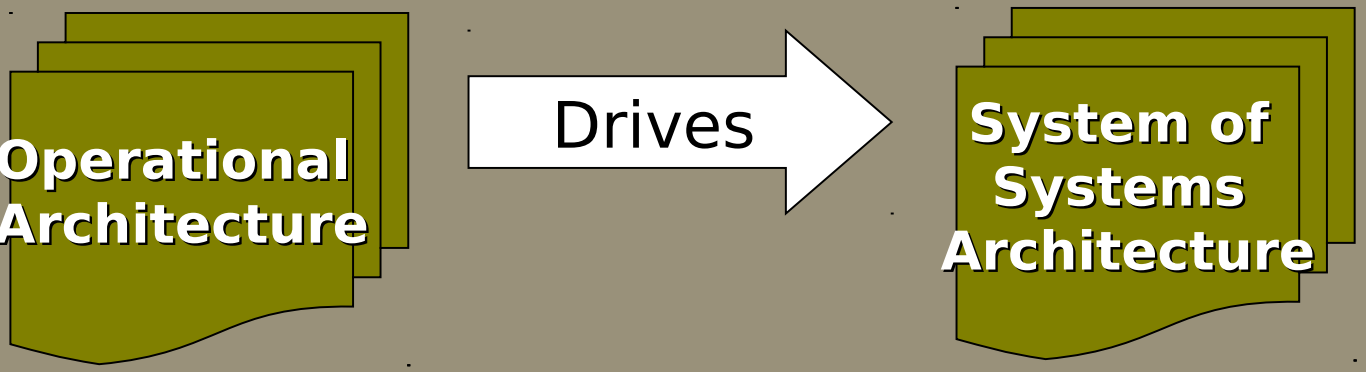
FFW Spiral Development Approach

- **Four (4) iterative Design Cycles**
  - ***Incremental design, prototyping & integration***
  - ***Increasing capability with each Design Cycle (DC)***
  - ***Technology & integration maturity levels increase with each Cycle***
  - ***Early focus on infrastructure, architectures, critical tradeoffs & technology runoffs***
  - ***Logical & sequenced Analysis, Simulation & Experiment feedback loop influences each ensuing DC***
- **Reduces risk & promotes system robustness**

Design Cycle Themes			
DC 1	**DC 2**	**DC 3**	**DC 4**
Stabilize Architectures	**Stabilize Requirements**	**Stabilize Design**	**Stabilize Products**

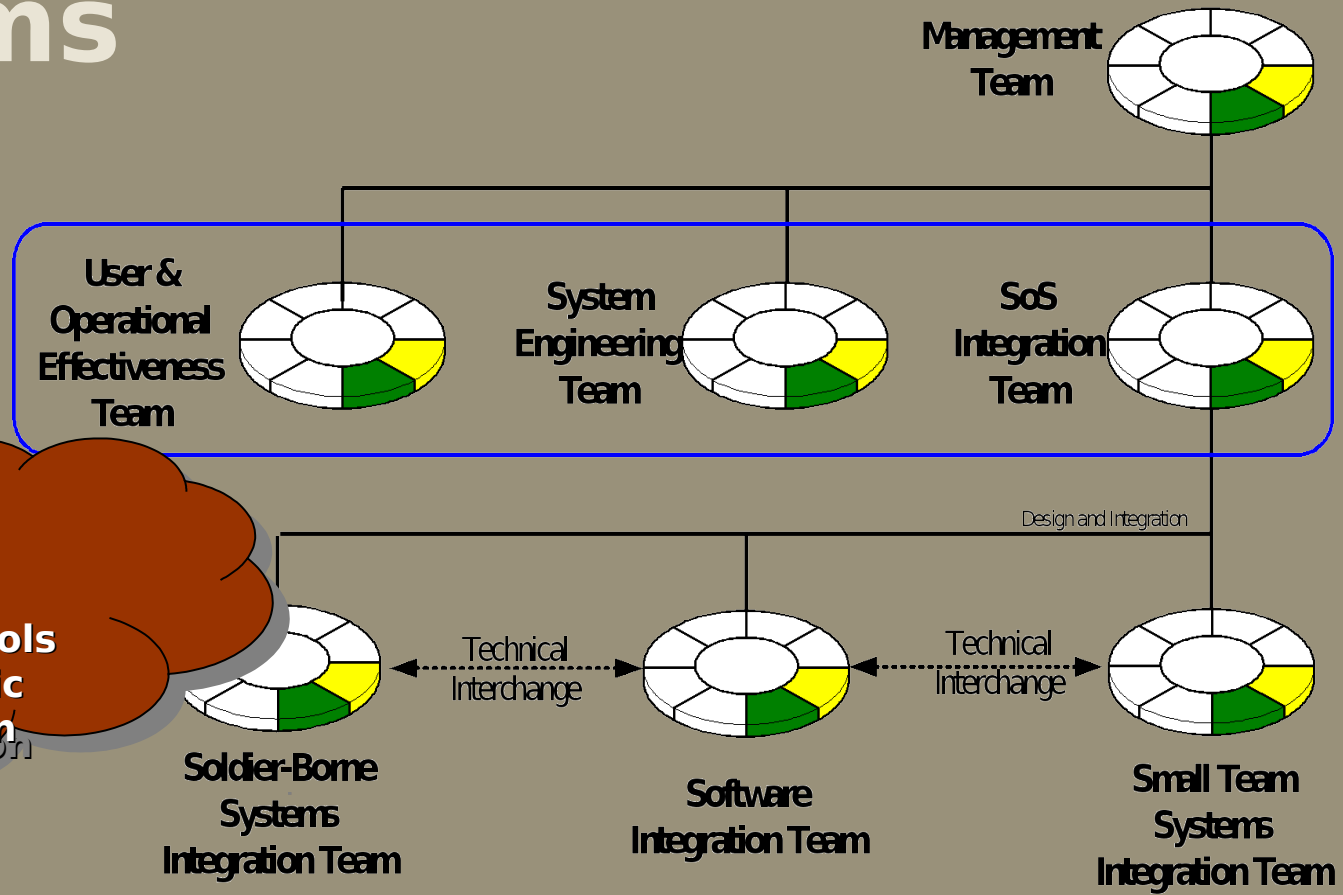
Capability Driven Systems

- **Ensure FFW system of systems is driven by demonstrable operational payoff & combat advantage**
  - Avoid “technology driven” architecture
  - Technology must “earn” it’s way into the system



- **FFW Systems & Integration teams**
  - Manage Spiral Development Process
  - Ensure capability driven solutions

Systems & Integration Teams



Process Discipline
- ✓Information Tools
- ✓Decision Logic
- ✓Configuration Managem't

Horizontal Team Integration is Essential

Operational Architecture

- **Provides the *vision, direction & force* that propel the System of Systems & Technical Architectures**

Tasks
Operational Elements
Information Flows

→ **Necessary to accomplish or support**

Ground Soldier & Small Combat Unit Warfighting Functions

- **Includes the task and purpose of information exchanges**
- **Addresses Future Force Unit of Action *methods of tactical assault***
  - *Mounted enabled by dismounted*
  - *Dismounted enabled by mounted*
  - *Dismounted*
  - *Mounted*
  - *Air Assault*

System of Systems Architecture (SOSA)

- ***Interconnects & integrates*** **FFW system architectures within the Small Combat Unit (SCU)**
  - *Soldier Borne Systems (SBS) Architecture*
  - *Software Systems Architecture*
- **Identifies *Distribution of Capabilities* across Soldier Borne & Small Team Systems within the SCU**
- **Defines interconnections & interfaces with *external systems***
- ***Open Architecture Imperative*** **to facilitate**
  - *System upgrades & technology insertion*
  - *System re-configurations & mission tailoring*
  - *Horizontal Technology Integration (HTI) across all Soldier domains*
    - Core, Ground, Mounted & Air Soldier Systems per TRADOC's SaaS concept

Technical Architecture

- ***Rules & "Building Codes"*** **to guide FFW system specifications & designs**
- **Provides *common standards & protocols***
  - *For sending, receiving, understanding & processing information*
  - *Rules for protecting information*
  - *Soldier – Computer Interface Standards*
- **Enables mapping of Soldier standards to FCS standards**
  - *Facilitates Soldier to FCS interoperability*
- ***Enforces*** **Open System Architecture via**
  - *Maximum use of Common Commercial Interfaces & Industry Standards*
- **Joint Technical Architecture – Army (JTA-A) Compliant**

Critical Architecture Drivers

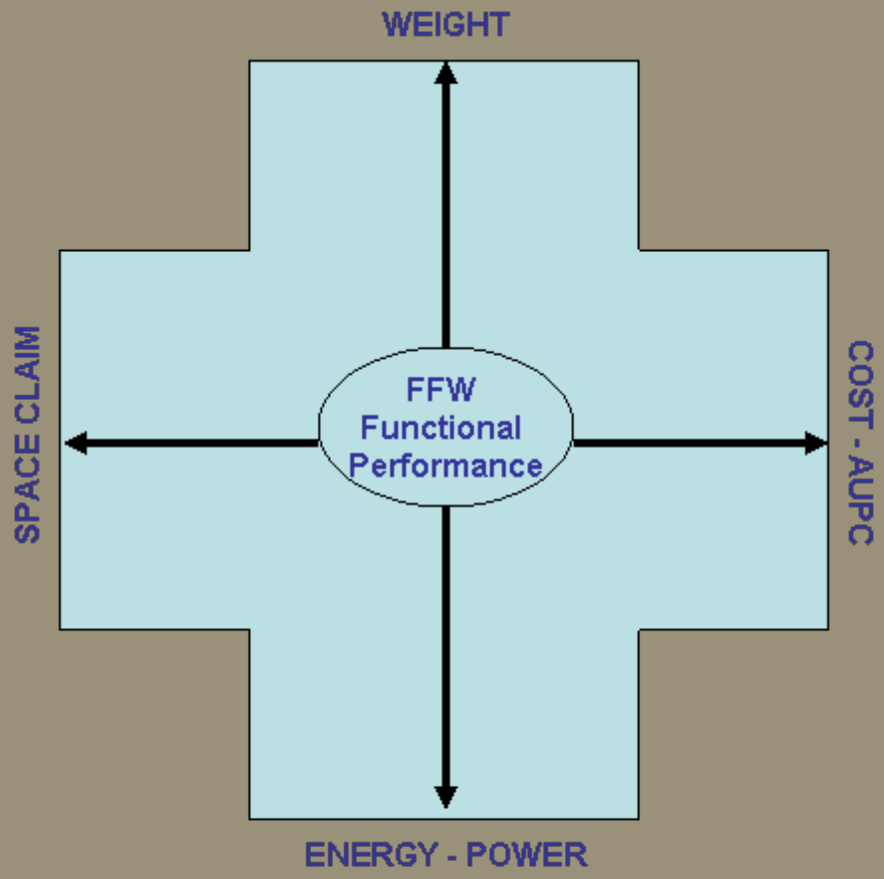
- ***Concepts & Capabilities that***
  - Exploit & apply the power of the Joint Force to the advantage of the SCU
    - Dominant combat power at the “tip of the spear”
  - Provide decisive advantage for the SCU operating in “stand-alone”, “organic capability” mode
- ***Conclusive analysis & experimentation results***
- ***Reduce power demand and intelligent power management***
  - Enhance mission endurance
- ***Minimize Soldier load (50 pound target for Rifleman)***
  - Keep Soldiers physically & mentally fresh
- ***Improve logistics support & affordability***
  - Total Ownership Cost

Critical FFW Capabilities

- Networked, Available Small Combat Unit (SCU) Communications
- Interoperability with FCS Unit of Action & Joint Force
- User Defined Operational Picture (UDOP)
- Organic & Reach-back ISR
- Embedded Planning, Training & Rehearsal
- Battle Execution Monitoring
- SCU Combat Power Integrated with Joint Fires
  - Synchronized, Cooperative Engagement
- Enhanced, Lightweight Protection
- Physiological Monitoring & Enhanced Casualty Care
- Unmanned Ground & Air Vehicle Interoperability
- Extended Mission Duration
- Faster Operational Tempo

Performance & Technology Trade Offs

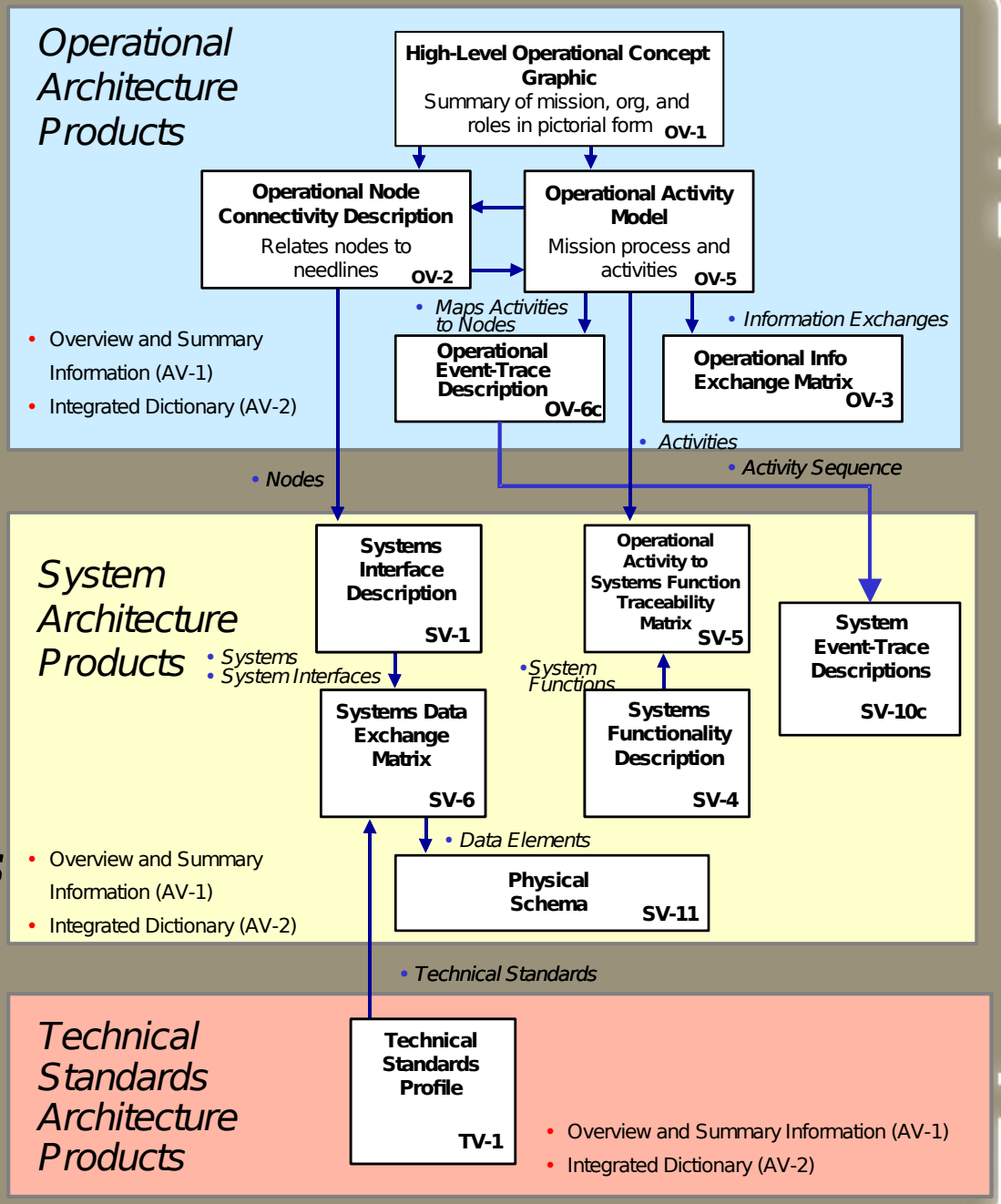
- **Critical Trade Offs**
  - Performance Requirements
  - Technology Selection to Achieve Critical Capabilities
- **Critical Parameters**
  - Cost
  - Energy
  - Weight
  - Volume
- **Defines Path toward**
  - FFW Technology & System of Systems to be Demonstrated at TRL 6
  - Influencing Ground Soldier CDD for Milestone B (FY07)



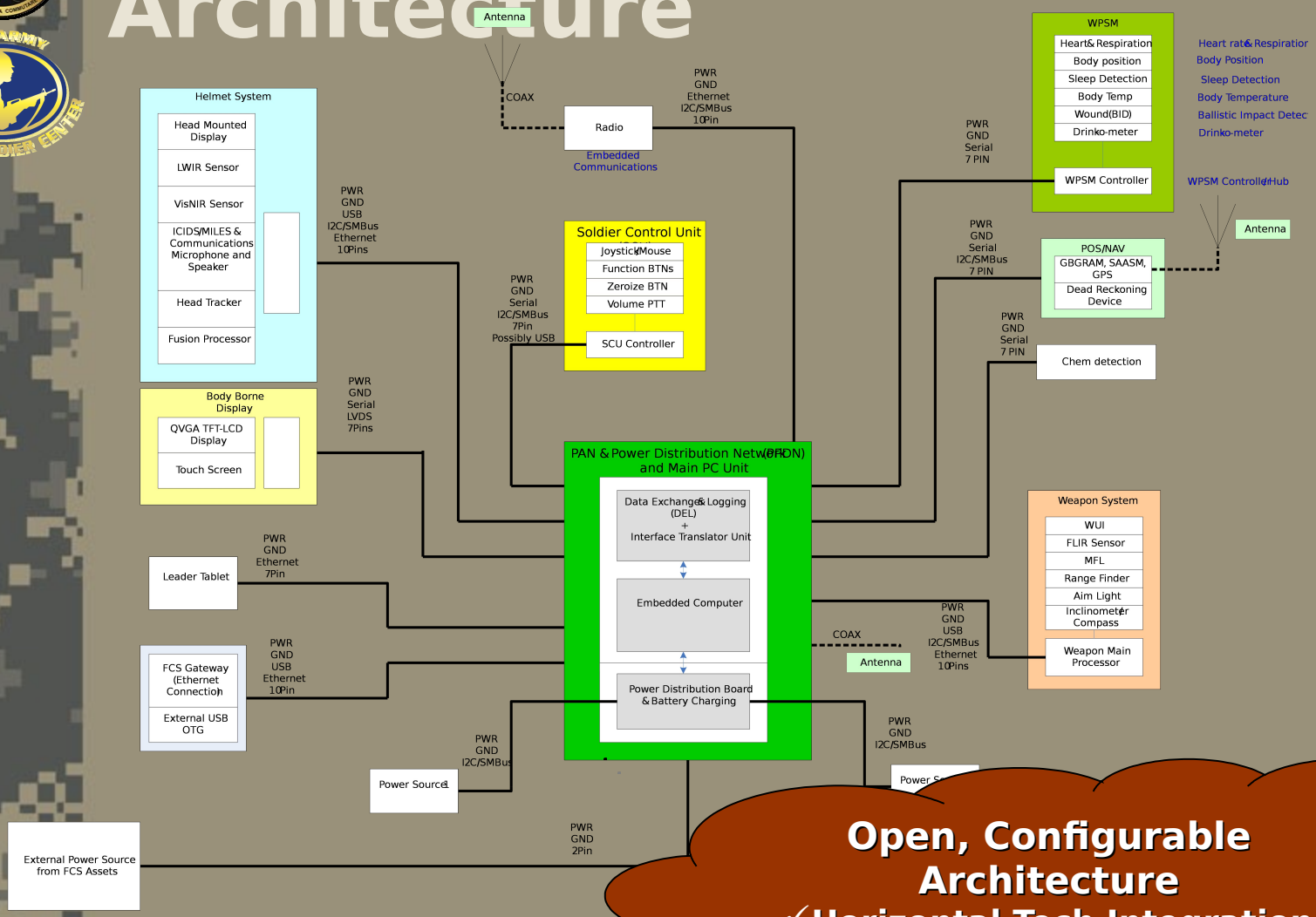
GOAL: BALANCED SYSTEM

FFW Architecture Products under Development

- **DODAF Compliant**
  - ***Operational Views***
  - ***System Views***
  - ***Technical Views***


Operational Architecture Products
High-Level Operational Concept Graphic
Summary of mission, org, and roles in pictorial form OV-1
Operational Node Connectivity Description
Relates nodes to needlines OV-2
Operational Activity Model
Mission process and activities OV-5
• Maps Activities to Nodes
• Information Exchanges
• Overview and Summary Information (AV-1)
• Integrated Dictionary (AV-2)
Operational Event-Trace Description OV-6c
Operational Info Exchange Matrix OV-3
• Activities
• Activity Sequence
• Nodes
System Architecture Products
• Systems
• System Interfaces
Systems Interface Description SV-1
Operational Activity to Systems Function Traceability Matrix SV-5
System Event-Trace Descriptions SV-10c
• System Functions
Systems Data Exchange Matrix SV-6
Systems Functionality Description SV-4
• Data Elements
• Overview and Summary Information (AV-1)
• Integrated Dictionary (AV-2)
Physical Schema SV-11
• Technical Standards
Technical Standards Architecture Products
Technical Standards Profile TV-1
• Overview and Summary Information (AV-1)
• Integrated Dictionary (AV-2)

Soldier Borne System Architecture



Open, Configurable Architecture

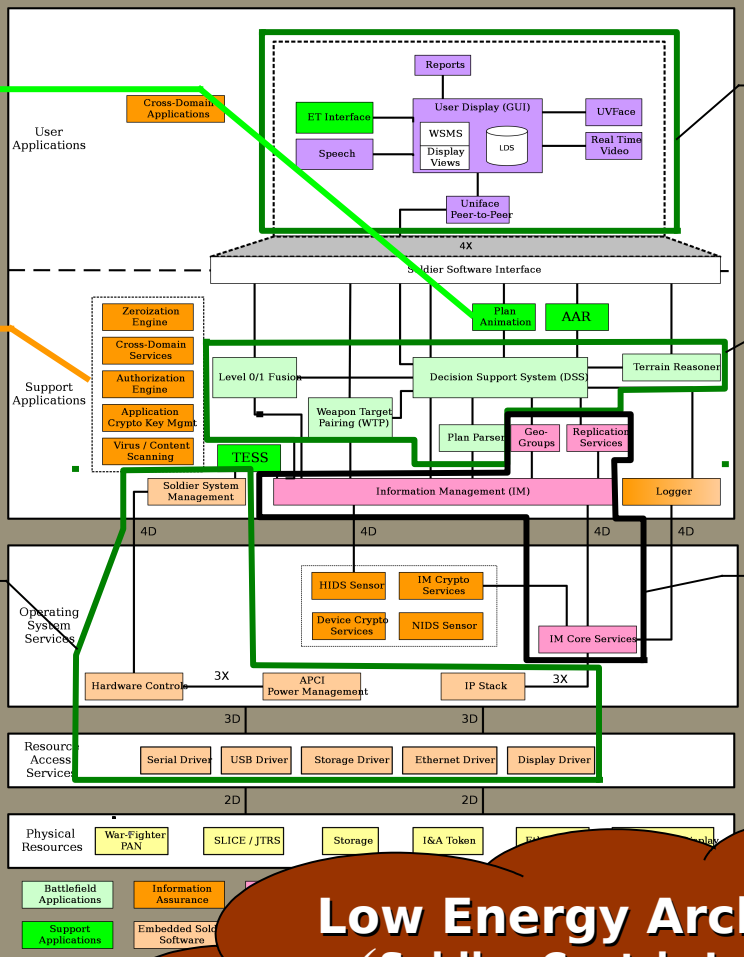
- ✓Horizontal Tech Integration
- ✓Capability distribution
- ✓Technology Upgrades

Software System Architecture

Embedded Training Components

Information Assurance Components

Soldier System Management Components



Soldier Software Interface Components

Battle Command Decision Support System Components

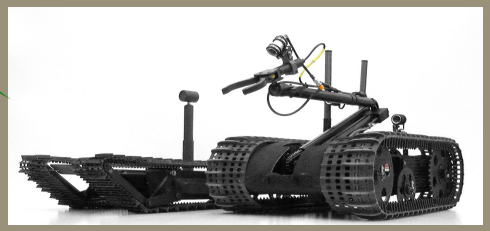
Information Management Components

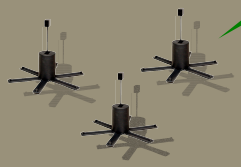
Low Energy Architecture

- ✓Soldier Centric Information Environment (SCIE)
- ✓Scaled to Available Processing
- ✓Cognitively Optimized for Ground Soldiers

Critical Interfaces with External Systems

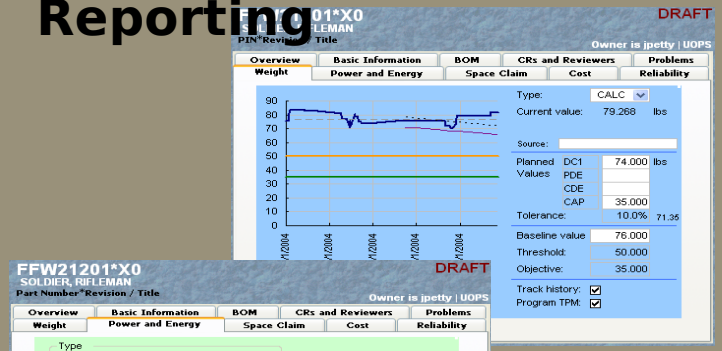
- **Future Combat Systems (FCS)**
  - **System of Systems Common Operating Environment (SOSCOE)**
  - **FCS Manned & Unmanned Ground Vehicles (MGV & UGV)**
  - **FCS Unmanned Aerial Vehicles (UAV)**
  - **Unattended Ground Sensors (UGS)**
- **Warfighter Information Network – Tactical (WIN-T)**
- **Joint Tactical Radio System (JTRS)**
- **Joint Fires Networks**

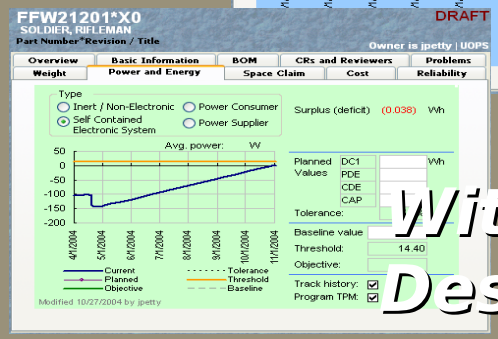




FFW System of Systems Metrics

- **Select Critical System Metrics**
- **Establish Threshold & Objective Measures**
- **Tracking Progress Monthly**
  - Report Major Deviations into Risk Management Process
- **Formal Quarterly Reporting**





Critical FFW Metrics

- **Small Combat Unit**
  - Weight
  - Cube
  - Unit Production Cost Estimate
  - Average Power
  - Energy
  - Mission Time
  - Network Loading (Bandwidth)
- **System Software**
  - Size (Lines of Code)
  - Processor Loading (Average & Peak)
  - Requirements Stability
  - Tests, Defects & Quality

Without Disciplined Metrics Tracking Design Goals not likely to be Achieve

Status & Path Forward

- **Formal FFW Revisions released 17 November 2004**
  - System of Systems Architecture
  - Operational Architecture
  - Technical Architecture
- **Schedule to be Released in January 2005**
  - Systems of Systems Specification
  - Interface Control Document
- **Complete DC 2 in FY05 to Stabilize FFW Demonstration Requirements**
  - Complete Analyses, Design Experiments & Trade Studies
  - Influence FFW Architectures with Feedback Logic
- **Continuing Technical Interchange with FCS team**
  - Ongoing Architecture Refinement
  - Key for robust Soldier to FCS Interoperability

Key FFW Technical Points of Contact

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